Water Pollution Control Department

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May 13, 2010

Donna Kniss
2110 E. Aurora Rd.
Twinsburg, Ohio 44087

Re: Brine Water Trial Pilot Study Summary

Donna,

Attached is our response to your questions emailed on Monday, May 10, 2010. I have attempted to answer them as completely as possible. I have also added some additional calculations concerning daily loading of chlorides. Please review and provide comments as necessary.

Thank you for your consideration of this opportunity and please call me if any additional information is needed or if there are any questions.

Thank you,

Thomas A. Angelo
Director
Water Pollution Control Center

Pc: Keith Riley
Virginia Wilson
Rich Blasick
Brian Hall
Paul Novak

The report mentions possible differences in TDS results from drying at 105 C and 180 C.

Regarding the TDS (evaporation method) you are correct, all testing was done at 105 C and no calculations were made to adjust for the temperature difference

The spreadsheet gives brine conductivity as mS. Does ms x 1000 = umhos/cm?

The brine testing conductivity (as well as a few on the final effluent) were in mS which requires a unit change to derive umhos/cm.

The sampling protocol information…

- Tonya explained to me that the 6 feet information was given to her by you and Erm and that you had guessed that was the measurement. In completing the report, I did not question this information and wasn't too concerned about the distance. On May 11, 2010, I had the distance between the Raw Sampler and the brine water discharge point measured. The distance is 10'1". I was not concerned about this because it is very unlikely for the flow from the Patriot Tanks to overcome plant flow. The discharge pipe that Patriot used was the established pipe that Septic Waste Haulers use to unload their tanks. It is a fitted pipe that points directly down into the tank. The discharge point is immediately south of #2 bar rack entrance. The Raw Sampler pipe is located immediately south of #1 bar rack entrance. Even with #2 bar rack closed, the flow pattern would be directly into #1 bar rack entrance from both the north and south areas. At maximum discharge, Patriot would only generate a flow of 1.67 cubic feet per second (cfs). The average plant flow, during the study, was 15.61 MGD or 24.2 cfs. The spike in influent parameters occurred on 4/13/10. Plant flow for that day was 13.254 MGD or 20.54 cfs. It is very unlikely that a flow of 1.67 cfs would have enough force to overcome a flow of 20.54 cfs ,even if the nozzle was pointed upstream into the flow, to carry 10' past an opening dragging the water away from the sampling point.

How many samples were included in the baseline?

- 12 samples were taken for Raw and Final TDS. 1 sample was tale for Raw and Final chloride. 2 samples were taken for up and down TDS, 1 sample was taken for chloride.

	TDS Raw	Chloride	Final	Chloride		Up TDS	Up Chloride	Down TDS	Down Chloride
1/4/2010	580		616		1/8/2010	344.0	70.0	328	67
1/19/2010	672		636		2/2/2010	328.0		336	
1/21/2010	668		716						
1/25/2010	512		524						
1/26/2010	588		520						
1/27/2010	636		628						
1/28/2010	604		620						
2/2/2010	536		572						
2/3/2010	544		592						
2/4/2010	572		604						
2/5/2010	544		596						
2/8/2010	556		564						
	584	143	599	157		336	70	332	67

Baseline Levels	TDS	Chloride
Raw	584	143
Final	599	157
Up	336	70
Down	332	60
Liquid Sludge		296

What was the LLD on the gamma scan? How was K-40 activity determined?

Ram Chandrasekar, Ph. D., Manager of Lab Operations for the Bureau of Public Health Laboratories, Ohio Department of Health, provided this answer and table:

I have attached the LLD for all nucleotides by gamma analysis for water. Yes, K-40 is by gamma spec only.

TABLE 4 (continued)

ODH LABORATORY ESTIMATED TYPICAL DETECTION LEVELS
(A PRIORI)

WATER

Parameter	Bkg (cpm)	Efficiency (cpm/dpm)	Sample Aliquot, 1	Counting Time, min.	LLD pCi/l
I-131	0.166	0.004940	3.5	1440	1.00
Ba-140	6.09	0.003394	3.5	1440	36.1
Cs-137	7.25	0.002959	3.5	1440	14.4
Cs-134	7.92	0.003185	3.5	1440	13.9
Zn-65	2.78	0.002060	3.5	1440	12.8
K-40	0.069	0.001755	3.5	1440	2.40
Ba-133	10.42	0.01045	3.5	1440	8.97
Co-58	2.95	0.002583	3.5	1440	6.10
Co-60	2.66	0.001889	3.5	1440	13.8
Mn-54	3.9	0.00433	3.5	1440	12.1
Fe-59	0.05	0.00193	3.5	1440	1.8
Zr-95	0.08	0.00240	3.5	1440	1.9
Nb-95	0.06	0.002513	3.5	1440	1.9
La-140	0.01	0.00160	3.5	1440	0.98
Tritium	10.0	0.663	0.004	100	300*
U (total)	0.04	0.2274	1.0	50	1.0
Alpha	0.05	DT=0(0.194)	0.1	100	3.0
Beta	0.60	DT=0(0.498)	0.1	100	4.0*
Ra-226	0.40	0.21	1.0	100	1.0
Ra-228	0.20	0.03756	1.0	50	1.0
Sr-90	0.60	0.484	1.0	50	1.0
Sr-89	0.20	0.4765	1.0	50	1.0

* NRC minimum required LLD ranges from 4 to 3000 pCi/l for these radioisotopes (See Table 2).

Please provide more information to 4/3 TUc detection…

Patriot Water was given a specific directive to discharge between the hours of 7am to 3pm from the one existing discharge meter point. Due to a miss-understanding by Patriot, when septic trucks entered the facility , the time available to discharge into the metered port was limited causing them to discharge large amounts of water in short bursts (slug loads). The maximum amount of water through the ports at different times could have reached 750 gpm for Patriot to make the deadline. Patriot did not keep written records of the start and stop times except for the 7am -3pm for discharge nor did we keep records of the gpm. Just prior to the 4/3 TUc detection, they experienced a significant increase in septic trucks. The increase in delay times caused the slugs to vary significantly prior to sampling that week.

I asked Courtney VanVoorhis, Laboratory Manager, Aquatic Biologist for EnviroScience, Inc. to better explain the toxicity and she provided the following dialog. "A TUc is called the chronic toxicity unit. The chronic toxicity unit is a unit less value (not a percentage or milligrams) that the EPA has determined to help compare toxicities of different effluents. The higher the number the worse the toxicity. It is directly proportional to the concentration of effluent that affects the organisms (determined by statistics). For example, a TUc of 1.8 would indicate a toxic effect to the water fleas at 57% effluent. Because of Warren's dilution series the highest TUc that can be determined is a 10.0. The lowest TUc is typically a 1.0 or less than 1.0 which indicates there is no toxicity at 100% effluent. Therefore a TUc of 1.8 does not indicate a lot of toxicity especially considering the receiving water (Mahoning River) and other dischargers upstream and downstream of the Warren WWTP."

The toxicity was observed at the end of week 6. Average TDS discharged during this week was 23,018 mg/l with the highest discharge measured being 57,990 (lab measured. Patriot's bench sheets did not demonstrate a reading that exceeded 44,870 mg/l). The highest daily average TDS discharged was for Monday, March 29, 2010. This average was 32,635 mg/l per the daily bench sheets. Tuesday's TDS average was 28, 759 mg/l. All remaining days averaged less than 17,000 mg/l TDS. Average weekly TDS readings the week prior to this week and all following weeks were higher. The week prior and the following weeks were all at 100,000 gallons per day.

The problem with this information is that we are assuming that the slug loads caused the mild toxic condition. The probability of statics would suggest another cause. No other week demonstrated toxicity even though loadings, in some cases were higher. Toxicity readings were noted in the upstream flow on February 19, 2010 and again on April 16, 2010. The study was not a closed system model. As indicated in the report, non-point source activity is affecting our raw influent. Therefore, it is possible that another source, received through the collection system, may have caused the mild toxicity. This does not rule out the brine water but it also does not make it the only potential source.

What caused the noticeable spike in influent conductivity, TDS and Chloride on 4/14?

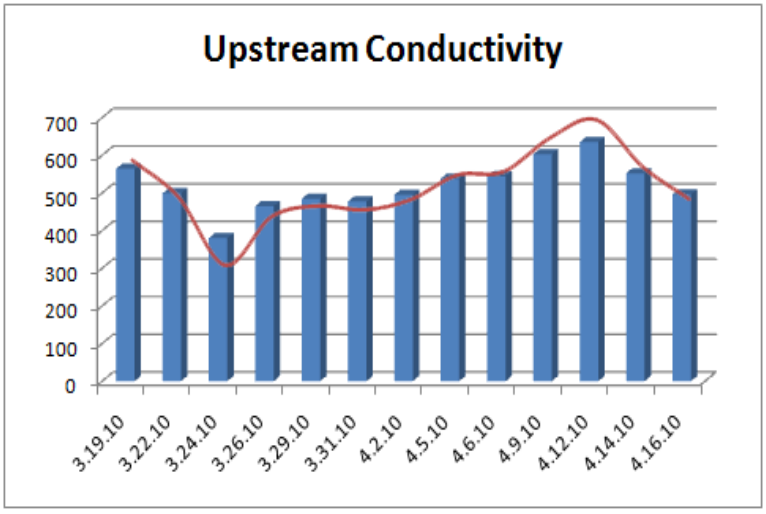
Short answer…I don't know. Assumptions…3 industries were in the process of coming back on-line during the later part of March and April. General Motors had initiated operations in late January so it is unlikely that any activity from them could have caused the spike. Mittal Steel and Severstal were both in the process of cleaning off the moth balls and ramping the facilities up for operation. Severstal is a know point-source for TDS. We have never measured Mittal for TDS but I assume that there is some in their effluent. Either of these facilities may have flushed their system on that particular day. Or, the reading could be an error, but I left it in because I could not determine if it was correct or incorrect.

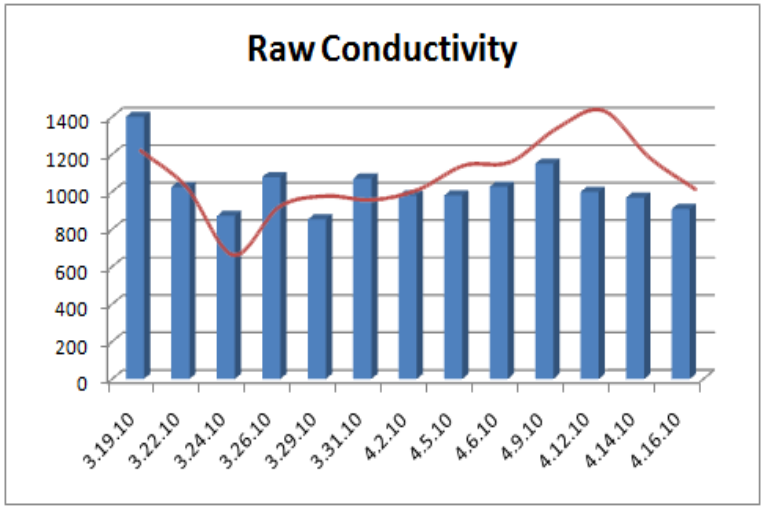
What caused the high effluent results on 4/13, 4/14, and 4/15?

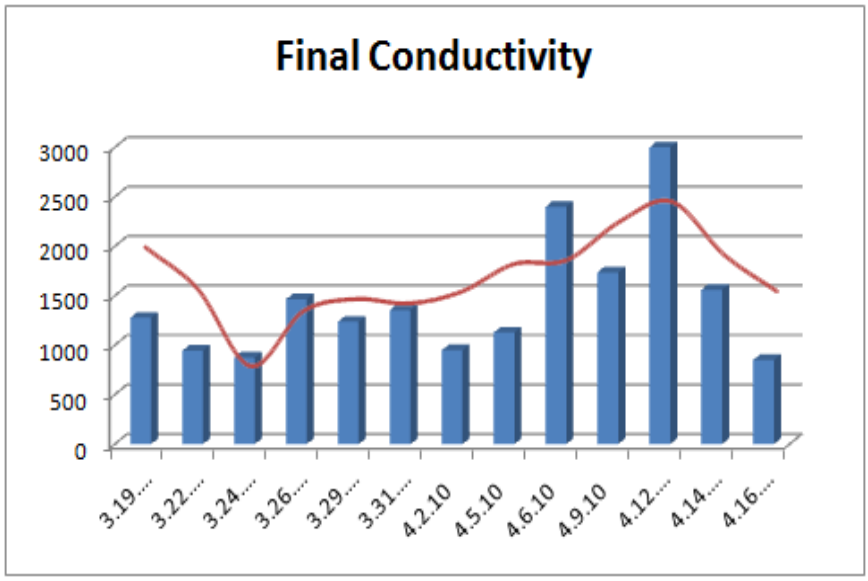
This is another difficult one to target. Towards the end of the study (week 7 and week 8) Patriot was receiving higher concentrations of brine water than in weeks past. Weekly TDS averages are displayed in the following table.

Week	Avg TDS
1	32,720
2	9,125
3	26,495
4	34,692
5	38,974
6	20,793
7	46,867
8	30,415

As demonstrated by the table, week 7 had the highest concentrations of TDS for the whole study. But the spikes occurred on the 13th and 14th of April which is in week 8. TDS levels began dropping off on the 15th. What makes this difficult to analyze is that the highest levels of daily TDS occurred April 7th and 8th. One would assume that the highest effluent spikes would occur on these days, however outside influences had an effect on the overall process as noted in the following charts.







The Charts are all based on Daily Upstream sampling days.

As demonstrated by the Upstream Conductivity chart, TDS levels in the river started to increase with the peak occurring on April 12th. The raw influent followed the same pattern with the highest peak occurring on April 13th. This pattern was emulated in the final effluent with the highest peak occurring on April 14th. Obviously, the collection system and treatment process are being affected by the same influences that are affecting the river upstream of the plant's outfall. It is unknown as to what exactly is contributing to these increases but it can be assumed to be winter de-icing salts being washed from roads into receiving streams and the collection system.

There was a rain event that occurred on April 9th that generated .24 inches of precipitation. This is approximately when the TDS levels began to increase on all three charts. Another rain occurred on April 10th that generated .05 inches of precipitation. Rain events on April 13th and 14th generated .20 inches and .06 inches of rain that escalated runoff. These rain events coincide with the increases in TDS in all three areas as noted on the charts. This background escalation of TDS entering the collection system augmented the TDS being discharged by the brine water. The spike was already occurring, influenced by natural events, and was simply amplified in the final effluent by the discharge of brine water.

SUMMARY

While I had provided a summary in my initial report, I am adding this information which provides a better model of loading in terms of pounds of chlorides to the river. To achieve this, I obtained the chart from USGS that shows the Mahoning River flow in cubic feet per second. I than broke out the dates that the study occurred and totaled the flow, dividing by the total number of days to establish an average daily flow in cubic feet per second. I converted this number to million gallons per day and used this to calculate pounds applied. The following tables demonstrate the results of these calculations.

BASELINE DAILY CHLORIDE LOADINGS

Avg River Flow MGD	Upstream Avg Daily Load lbs/day	Downstream Avg Daily Load lbs/day	Plant Avg Daily Load lbs/day
867.27	506,314.39	484,615.20	20,439.42

STUDY RESULTS - DAILY CHLORIDE LOADINGS

	Upstream		Downstream			Plant Effluent	
Avg River Flow MGD	Avg Daily Load lbs/day	Peak Daily Load lbs/day	Avg Daily Load lbs/day	Peak Daily Load lbs/day	Avg Plant Flow MGD	Avg Daily Load lbs/day	Peak Daily Load lbs/day
867.27	852,488.76	1,612,972.97	873,134.10	1,446,612.53	15.61	46,867.46	118,995.12
% Over Baseline	168.37	318.57	180.17	298.51		229.30	582.18
Lbs. Over Baseline	346,174.38	1,106,658.59	388,518.90	961,997.33		26,428.04	98,555.70

PERCENT OF CHLORIDE DAILY LOAD TO RIVER FROM PLANT EFFLUENT

	During Study		Baseline
	Upstream		Downstream
	Avg Daily Load lbs/day	Peak Daily Load lbs/day	Avg Daily Load lbs/day
Plant Effluent Avg.	0.05	0.03	0.09
Plant Effluent Peak	0.14	0.07	0.24

This information demonstrates that the river was able to assimilate a peak daily load of chloride 318% greater than the baseline loading without any toxicology issues. In total pounds applied this means that an additional 1,106,658 pounds of chlorides over baseline was assimilated without adverse affects to the river biology. Warren's highest peak daily loading of chloride was only 118,995 pounds.

This information shows that even with some of the disruptions to the study, as noted in this response, the methodology for handling the brine water used in the pilot study is sound. Therefore, Patriot should be permitted to restart the system, using the existing pilot study equipment, discharging at an initial rate of 100,000 gallons per day. The flow rate will increase at a controlled amount, with monitoring and sampling, to a maximum of 200,000 per day over a 16 hour period.

I believe that it is only right that we allow Patriot employees to get back to work while we finalize NPDES and PTI issues. It is easy to slowly consider our collective next move from a secured paid position. We need to put ourselves in the shoes of those Ohioans who do not have this luxury. Any further concerns or questions can be resolved while operations continue.

I look forward to meeting with OEPA to move this industry forward in a positive direction.

Sincerely,

Thomas A. Angelo
Director
Water Pollution Control